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2008 Annual Industrial Wastewater Reuse Report for the Idaho National Laboratory Site's Advanced Test Reactor Complex Cold Waste Pond

Michael G. Lewis

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ABSTRACT

This report describes conditions, as required by the state of Idaho Industrial Wastewater Reuse Permit (#LA-000161-01, Modification B), for the wastewater land application site at the Idaho National Laboratory Site's Advanced Test Reactor Complex Cold Waste Pond from February 26, 2008 (date of original permit issuance), through October 31, 2008. The report contains the following information:

- Site description
- Facility and system description
- Permit required effluent monitoring data and loading rates
- Groundwater monitoring data
- Status of special compliance conditions
- Discussion of the facility's environmental impacts

During the 2008 permit year, approximately 129 million gallons of wastewater was discharged to the Cold Waste Pond. As shown by the groundwater sampling data, sulfate and total dissolved solids concentrations are highest near the Cold Waste Pond and decrease rapidly as the distance from the Cold Waste Pond increases. Although concentrations of sulfate and total dissolved solids are elevated near the Cold Waste Pond, both parameters were below the Ground Water Quality Rule Secondary Constituent Standards in the down gradient monitoring wells.

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ACRONYMS

Al	Aluminum
ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance, LLC
bgs	below ground surface
CFR	Code of Federal Regulations
CWI	CH2M-WG Idaho, LLC
CWP	Cold Waste Pond
DEQ	Idaho Department of Environmental Quality
Fe	Iron
gpd	gallons per day
IDAPA	Idaho Administrative Procedures Act
INL	Idaho National Laboratory
IWRP	Industrial Wastewater Reuse Permit
EMS	Environmental Monitoring Services
MG	Million gallons
Mn	Manganese
NA	Not Applicable
O&M	Operating and Maintenance (Manual)
PIV	post indicator valve
PCS	Primary Constituent Standard
SCS	Secondary Constituent Standard
TDS	total dissolved solids
TN	total nitrogen
TSS	total suspended solids
USGS	United States Geological Survey

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1 INTRODUCTION

The Advanced Test Reactor Complex (ATR Complex, formerly Reactor Technology Complex) Cold Waste Pond (CWP) is an industrial wastewater reuse treatment facility operated by Battelle Energy Alliance, LLC (BEA) under Industrial Wastewater Reuse Permit (IWRP) #LA-000161-01 issued by the state of Idaho Department of Environmental Quality (DEQ) on February 26, 2008 and will expire on February 25, 2013 (Johnston 2008). The permit was modified (Modification B) on August 20, 2008 (Eager 2008).

Following the Section 2 CWP site, facility, and system description, this report presents the status of monitoring data, special compliance conditions, non-compliances, and environmental impacts of the CWP operation during 2008 (beginning February 26, 2008 through October 31, 2008). For 2008, the permit year began on the date the permit was issued. For subsequent years, as required by the permit, the reporting year will be November 1 through October 31.

2 SITE, FACILITY, AND SYSTEM DESCRIPTION

The ATR Complex (Figure 1) is located on approximately 100 acres in the southwestern portion of the INL, approximately 47 mi. west of Idaho Falls, Idaho, in Butte County. The ATR Complex consists of buildings and structures utilized to conduct research associated with developing, testing, and analyzing materials used in nuclear and reactor applications and both radiological and nonradiological laboratory analyses.

The CWP is located approximately 450 ft. from the southeast corner of the ATR Complex compound (Figure 1) and approximately 1 mile west of the Big Lost River channel. The existing CWP was excavated in 1982. It consists of two cells, each with dimensions of 180 × 430 ft. across the top of the berms, and a depth of 10 ft. Total surface area for the two cells at the top of the berms is approximately 3.55 acres. Maximum capacity is approximately 10,220,000 gal (31.3 acre ft).

Wastewater discharged to the CWP consists primarily of noncontact cooling tower blowdown, once-through cooling water for air conditioning units, coolant water from air compressors, secondary system drains, and other nonradioactive drains throughout the ATR Complex. The wastewater flows through collection piping to the TRA-764 Cold Waste Sample Pit (Figure 1) where the flow rate is recorded and compliance monitoring samples are collected. The wastewater then flows to the Cold Waste Sump Pit (TRA-703). The sump pit contains submersible pumps that route the water to the appropriate CWP cell through 8 in. valves.

Wastewater enters the pond through concrete inlet basins located near the west end of each pond. Most of the water percolates into the porous ground within a short distance from the inlet basins. The entire floor of a cell is rarely submerged. If the water level rises significantly in a cell (e.g., 5 ft.) the flow would be diverted to the adjacent cell, allowing the first cell to dry out. An overflow pipe connects the two cells at the 9-ft. level.

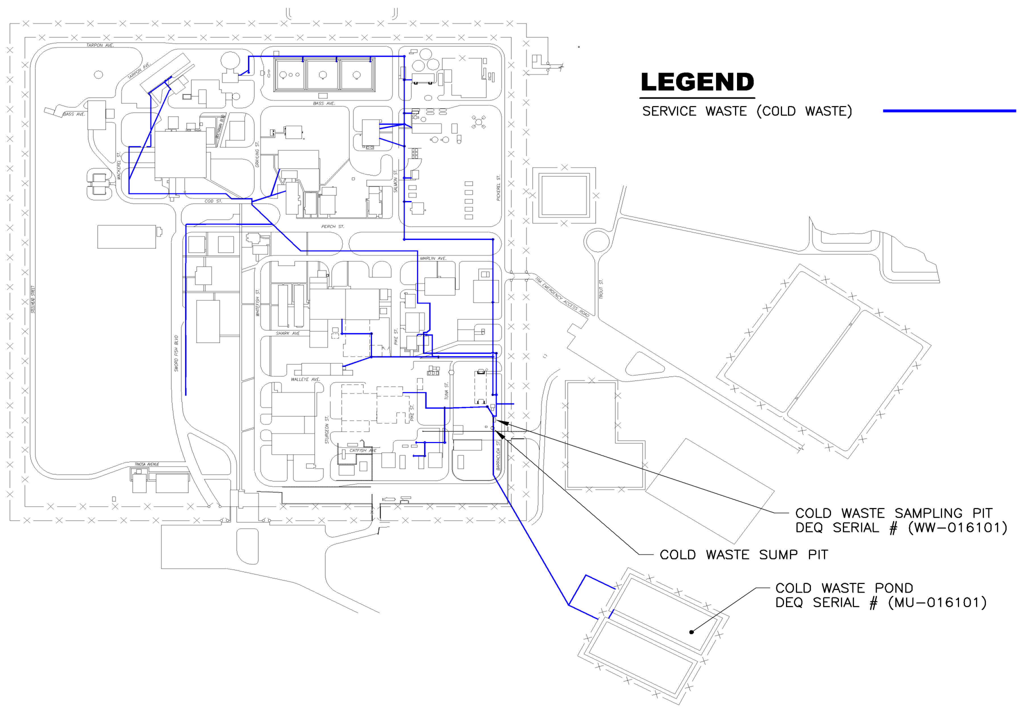

Figure 1. Advanced Test Reactor Complex Cold Waste system flow schematic.

3 COLD WASTE POND EFFLUENT MONITORING

This section describes the sampling and analytical methods used in the ATR Complex CWP effluent monitoring program. Effluent monitoring and flow data of wastewater discharged to the ATR Complex CWP is provided. Non-compliance issues concerning effluent monitoring are discussed in Section 5.2

3.1 Sampling Program and Analytical Methods

Environmental Monitoring Services (EMS) at the INL monitors effluent discharges at the ATR Complex CWP. The EMS involves sampling, analysis, and data interpretation carried out under a quality assurance program.

The ATR Complex CWP permit was issued on February 26, 2008. The first sampling event required by the permit occurred on March 6, 2008. Following permit issuance, EMS conducted monthly effluent monitoring as required in Section G of the permit. Effluent samples were collected from the TRA-764 Cold Waste Sample Pit (sampling location WW-016101) prior to discharge to the CWP. All samples were collected according to established programmatic sampling procedures.

Effluent samples were taken during a preselected week each month following a randomly generated sampling schedule to represent normal operating conditions. All samples were analyzed using methods identified in 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants" or approved by the DEQ.

3.2 Effluent Monitoring Results

The permit year covered in this report is February 26, 2008 (permit issuance), through October 31, 2008.

Beginning with the March 2008 sample, effluent samples were collected monthly from the TRA-764 Cold Waste Sample Pit (prior to discharge to the CWP) during the permit year. All effluent samples, with the exception of the April 23rd sample, were collected as 24-hour composite samples. As discussed with the DEQ (Lewis 2008), the April 23rd sample was collected over approximately 18 hours and resulted in 58 aliquots. It was later discovered that the screws on the composite sampler pump housing had come loose and caused the sampler to collect more sample volume than the sampler was programmed for. The screws were tightened prior to the collection of the May sample.

All samples, with the exception of the May through October total dissolved solids (TDS) samples, were collected and analyzed as required by the permit. The May through October TDS samples were preserved incorrectly, resulting in these data being rejected. This issue was considered a noncompliance and is discussed in further detail in Section 5.2.1. Table 1 summarizes the effluent sampling results.

Section F of the IWRP specifies effluent permit limits based on a 30-day average for total nitrogen (TN) and total suspended solids (TSS) of 20 mg/L and 100 mg/L, respectively. Total nitrogen is calculated as the sum of total Kjeldahl nitrogen and nitrate plus nitrite nitrogen. The high for TN occurred in May at 3.871 mg/L with a low of 1.239 mg/L in April and June. All TSS results were below the laboratory instrument detection limit of 4 mg/L.

There are no effluent permit limits for TDS or sulfate. A summary comparison of these parameters with the Ground Water Quality Rule Secondary Constituent Standards (SCS) found in the Idaho Administrative Procedures Act (IDAPA) 58.01.11.200.01.b. follows.

The TDS SCS is 500 mg/L. The concentration in the effluent to the CWP ranged from 244 mg/L in the April sample to 1,090 mg/L in the March sample. The May through October sample data was rejected and will not be used for comparison purposes.

Sulfate concentrations in the effluent were above the SCS of 250 mg/L in five of the eight monthly samples (Table 1). Sulfate ranged from a minimum of 21.2 mg/L in the March sample to a maximum of 618 mg/L in the May sample.

The ATR evaporative cooling process evaporates approximately one-half of the water volume and concentrates naturally occurring dissolved solids in the blowdown discharged to the CWP. Sulfates are generated by reactions between sulfuric acid additives placed in the cooling water and calcium and magnesium carbonates in the water.

The metals concentrations in the CWP effluent remained at low levels (Table 1). Concentrations of several metals in the effluent were consistently below the laboratory instrument detection levels.

In general, certain effluent constituent concentrations are dependent upon the operational status of the ATR. When the ATR is operating, the evaporative cooling process (cooling tower) concentrates constituents discharged to the CWP. For example: several Table 1 parameters are elevated in March and again in May (to approximately the same values for the respective constituents) when the ATR was operating. By contrast, April and June values are relatively low (and similar for the respective constituents) when the ATR was shut down.

Table 1. Advanced Test Reactor Complex Cold Waste Pond effluent data (WW-016101).

Sample Month	November	December	January	February	March	April	May	June	July	August	September	October
Sample Date[a]	—	—	—	—	03/06/08	04/23/08	05/14/08	06/26/08	07/23/08	08/05/08	9/17/08	10/07/08
Nitrite + nitrate as nitrogen (mg/L)	—	—	—	—	3.18	0.919	3.5	0.909	3.28	2.65	0.899	3.18
Total Kjeldahl nitrogen (mg/L)	—	—	—	—	0.244	0.32	0.371	0.33	0.424	0.338	0.376	0.41
Total nitrogen[b] (mg/L)	—	—	—	—	3.424	1.239	3.871	1.239	3.704	2.988	1.275	3.59
Total suspended solids (mg/L)	—	—	—	—	4.0 U[c]	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Total dissolved solids (mg/L)	—	—	—	—	1,090	244	3,110 R[d]	687 R	4,190 R	1,620 R	1,390 R	2,990 R
Chloride (mg/L)	—	—	—	—	36.1	10.6	36.9	10.6	35.0	32.1	10.7	35.1
Electrical conductivity (µS/cm)	—	—	—	—	1,300	624	1,400	544	1,291	1,142	453	1,257
Arsenic (mg/L)	—	—	—	—	0.0069	0.005 U	0.0057	0.005 U	0.0063	0.005 U	0.005 U	0.005 U
Barium (mg/L)	—	—	—	—	0.168	0.0483	0.163	0.0482	0.147	0.139	0.0499	0.151
Cadmium (mg/L)	—	—	—	—	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium (mg/L)	—	—	—	—	0.0094	0.003	0.0116	0.0029	0.010	0.0094	0.0034	0.0073
Cobalt (mg/L)	—	—	—	—	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
Copper (mg/L)	—	—	—	—	0.005	0.0014	0.0047	0.0011	0.002	0.0064	0.001 U	0.0042
Fluoride (mg/L)	—	—	—	—	0.499	0.186	0.499	0.186	0.495	0.452	0.184	0.491
Iron (mg/L)	—	—	—	—	0.185	0.050 U	0.225	0.025 U	0.0777	0.0639	0.025 U	0.0416
Manganese (mg/L)	—	—	—	—	0.0073	0.0025 U	0.0056	0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0025 U
Mercury (mg/L)	—	—	—	—	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Selenium (mg/L)	—	—	—	—	0.0048	0.0011	0.0044	0.0012	0.0044	0.004	0.0012	0.0044
Silver (mg/L)	—	—	—	—	0.010 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Sulfate (mg/L)	—	—	—	—	593.0	21.2	618.0	22.2	586.0	458.0	22.6	548.0

a. Reporting year began on February 26, 2008. Only data collected after the start of the reporting year are presented in the table.
b. Total nitrogen is calculated as the sum of the total Kjeldahl nitrogen and nitrite + nitrate nitrogen.
c. U flag indicates that the result was reported as below the instrument detection limit by the analytical laboratory.
d. R flag indicates the data was rejected because the incorrect preservative was used to preserve the TDS samples.

3.3 Flow Volumes and Hydraulic Loading Rates

Daily flow readings were taken by ATR Complex CWP Operations during the 2008 permit year, as required by Section G of the permit, at the TRA-764 Cold Waste Sample Pit (WW-016101). All flow readings were recorded in gallons per day (gpd).

On 9/4-9/6 and again on 9/11-9/13, planned ATR Complex-wide electrical outages were performed to support the pulling/installation of new electrical feeds for various construction and power management projects. The electrical outages were coordinated with operations to temporarily eliminate/minimize wastewater discharge to the Cold Waste system (e.g. cooler/chiller water, cooling tower blowdown, etc. were temporarily ceased or diverted).

During the electrical outages, there was no power to the TRA-764 Cold Waste flow meter or to the Cold Waste system effluent pumps (TRA-703 pumps). Because the electrical outages were intermittent over these periods, the operators were unable to obtain flow meter readings while performing their daily rounds. However, the pump run times were available. Therefore, daily flow was estimated by scaling total flow recorded for 9/6 and 9/13 by pump operational hours for 9/4-9/6 and 9/11-9/13, respectively (see Appendix A).

Table 2 summarizes monthly and annual flow data. Daily effluent flow data is provided in Appendix A.

Table 2. Cold Waste Pond flow summaries.

	Effluent to Cold Waste Pond (WW-016101)			
Month	Average (gpd[a])	Minimum (gpd)	Maximum (gpd)	Total (MG[b])
November 2007	NA[c]	NA	NA	NA
December 2007	NA	NA	NA	NA
January 2008	NA	NA	NA	NA
February 2008	349,310	273,150	402,780	1.40
March 2008	690,792	319,540	991,880	21.41
April 2008	761,011	452,660	1,152,700	22.83
May 2008	354,504	189,430	633,080	10.99
June 2008	485,665	223,690	850,830	14.57
July 2008	470,895	280,020	903,400	14.60
August 2008	458,870	313,080	970,200	14.22
September 2008	491,113	216,000[d]	1,123,000	14.73
October 2008	467,604	253,010	766,020	14.50
Yearly summary	519,090	189,430	1,152,700	129.25

a. gpd—gallons per day.
b. MG—million gallons.
c. NA—Not Applicable. 2008 permit year began on February 26, 2008.
d. Low flows during the electrical outages were not used for the minimum.

The permit (Section F) specifies the following:

- Application season is year round.
- Maximum hydraulic loading rate is 300 million gallons (MG) as a 5-year annual average, not to exceed 375 MG annually.

Daily influent flow averaged 519,090 gpd. Daily flow ranged from a low of 189,430 gpd and a high of 1,152,700 gpd for the permit year. Total effluent flow volume was 129.25 MG for the 2008 permit year.

3.3.1 Flow Meter Calibration

Section G of the IWRP requires calibration of all flow meters and pumps used directly or indirectly to measure all wastewater applied to the CWP. The flow meter used to measure the flow volume to the CWP is located in the TRA-764 Cold Waste Sample Pit. The flow meter was calibrated on June 5, 2008 by the ATR Complex maintenance organization (work order #114374, "C06B Cold Waste Annual Calibrations"). The calibration was performed to +/- 2% of full scale.

4 GROUNDWATER MONITORING

The groundwater monitoring sections provide information concerning the INL sampling program, analytical methods used, monitoring results, and water table information. Non-compliance issues concerning groundwater are discussed in Section 5.2

4.1 Sampling Program

The ATR Complex CWP IWRP identifies five INL compliance wells. The permit requires that groundwater samples be collected from these five compliance wells in October 2008 then semiannually during April and October in subsequent years.

The EMS personnel performed the October 2008 groundwater sampling. The EMS personnel use project-specific sampling and analysis plans and procedures that govern sampling activities and quality control protocols. The permit identifies a specified list of parameters that are to be analyzed in the groundwater samples. Constituent concentrations in the compliance wells are limited by primary constituent standards (PCS) and SCS specified in IDAPA 58.01.11, “Ground Water Quality Rule.” All permit-required samples were collected as unfiltered samples.

4.2 Analytical Methods

Analytical methods specified in 40 Code of Federal Regulations (CFR) 141, “National Primary Drinking Water Regulations,” 40 CFR 143, “National Secondary Drinking Water Regulations,” 40 CFR 136, “Guidelines Establishing Test Procedures for the Analysis of Pollutants,” or those approved by DEQ were used for analysis of all permit-required parameters.

4.3 Monitoring Wells

To measure potential impacts to groundwater from the ATR Complex CWP, the permit requires that groundwater samples be collected from five monitoring wells located in the Snake River Plain Aquifer (see Figure 2):

- USGS-065 (GW-016102)
- TRA-07 (GW-016103)
- USGS-076 (GW-16104)
- TRA-08 (GW-16105)
- Middle-1823 (GW-16106)

All five wells are permit compliance points. Wells with sufficient water volume were purged to a minimum of three casing volumes or until field measurements met the conditions specified in Section G.5 of the IWRP. Four of the five wells had sufficient volume to purge and collect samples (see Section 4.4).

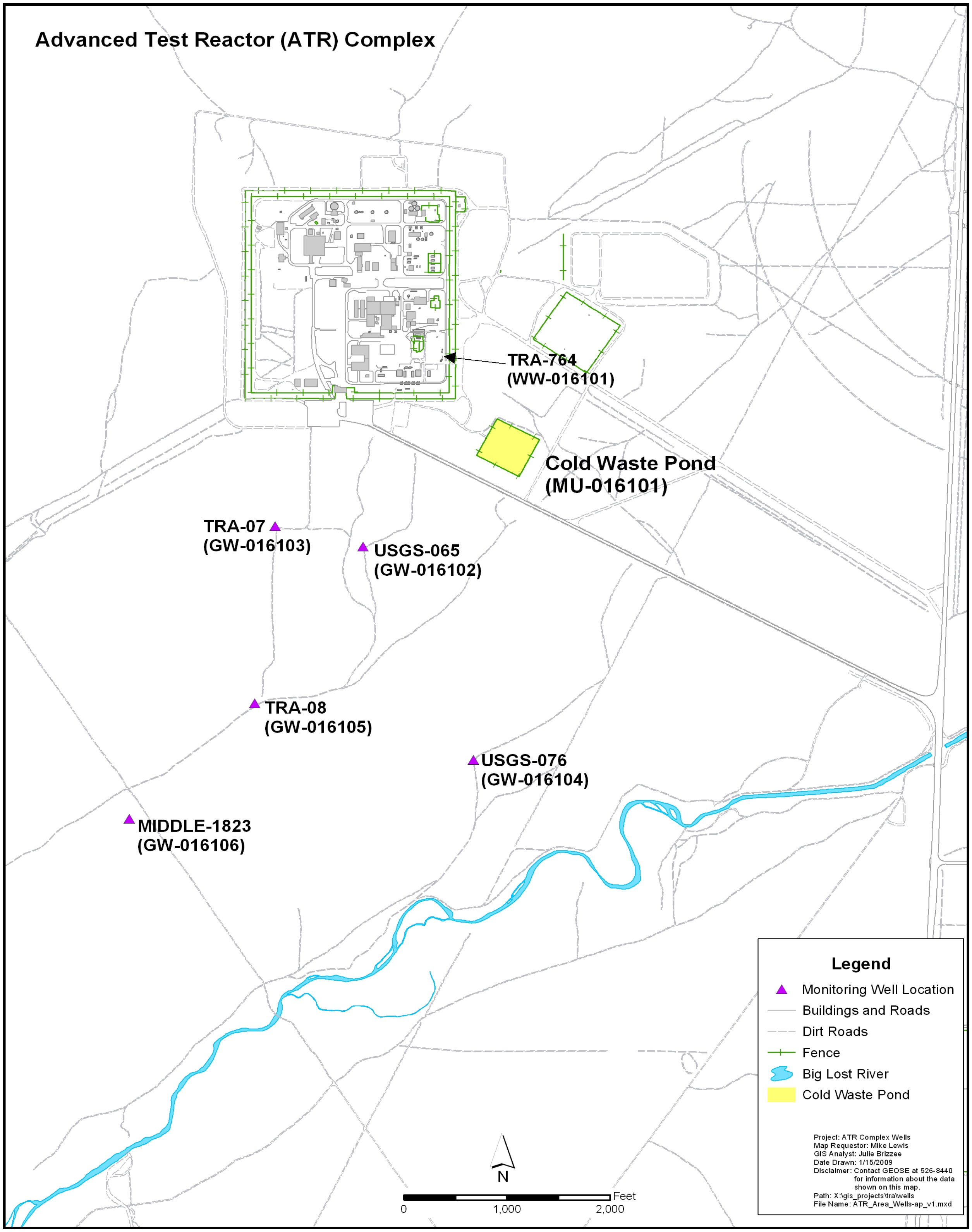

Figure 2. Locations of the Advanced Test Reactor Complex Cold Waste Pond Industrial Wastewater Reuse Permit monitoring wells.

4.4 Groundwater Monitoring Results

Table 3 shows the 2008 reporting year water table elevations and depth to water table, determined prior to purging and sampling, and the analytical results for all parameters specified by the permit for aquifer wells. As the table shows, the majority of the permit-required parameters were below their respective Ground Water Quality Rule (IDAPA 58.01.11) PCSs or SCSs during the 2008 reporting year for all wells associated with the ATR Complex CWP. Only aluminum (Al), iron (Fe), and manganese (Mn) exceeded the SCSs in the sample collected from well TRA-07. Section 5.2 covers permit non-compliances.

Down gradient aquifer Well TRA-08 was reported as dry during the October 2008 sampling event. As required by Section G.5 of the IWRP, wells with inadequate sampling volume are to be reported as "Dry."

Two failed attempts (October 15, 2008 and October 21, 2008) were made to collect samples from well TRA-08. During attempts to purge the well, water failed to reach the surface before the well went dry. On October 21, 2008, water from the well was pumped to 180 ft. below ground surface (bgs) before the well went dry. The pump was shut off for 15 minutes and then re-started again. Water reached 160 ft. bgs before the well went dry for the second time.

Well TRA-08 was installed in 1990. The depth to water in TRA-08 was 477.92 ft. bgs in March 1991 increasing to 486.56 ft. bgs in June 2005 and 489.89 ft. bgs in October 2008. The well is screened from 471.5 to 501.5 ft. bgs. The reduction in water column height and a slow recharge rate resulted in insufficient water volume for sample collection. Similarly, the depth to water has increased for the other permit required monitoring wells. However, there was sufficient water in these other wells to allow for purging and sample collection.

Monitoring well USGS-065 is the nearest down gradient well from the CWP. The SCS for sulfate and TDS are 250 mg/L and 500 mg/L, respectively. As expected, well USGS-065 had the highest concentrations of these two parameters but below the SCSs with sulfate at 160 mg/L and TDS at 427 mg/L. The other three permit wells sampled in October showed lower levels of these two parameters than found in USGS-065. Though the sulfate and TDS concentrations are elevated in USGS-065, the extent does not appear to be significant or far reaching.

4.5 Water Table Information

Depth to water and water table elevations for the five IWRP aquifer wells are shown in Figure 3. In addition, Figure 3 shows that the general groundwater flow direction based on water level measurements from the permit wells is to the southwest. This is consistent with the general groundwater flow direction determined for the INL Site.

Table 3. Advanced Test Reactor Complex Cold Waste Pond aquifer monitoring well groundwater quality data for the 2008 reporting year.

WELL NAME	**USGS-065 (GW-016102)**	**TRA-07 (GW-016103)**	**USGS-076 (GW-016104)**	**TRA-08 (GW-016105)**	**Middle-1823 (GW-016106)**	**PCS/SCS[a]**
Sample Date	10/13/08	10/16/08	10/27/08	10/15/08	10/16/08	
Water Table Depth (ft bgs)	476.17	484.85	484.1	489.89[b]	494	NA[c]
Water Table Elevation (above mean sea level in ft)	4452.35	4450.23	4449.11	4448.55[b]	4448.87	NA
pH	7.82	7.94	7.46	—[d]	7.87	6.5 to 8.5
Total Kjeldahl nitrogen (mg/L)	0.232	0.347	0.291	—	0.419	NA
Nitrite nitrogen (mg/L)	0.05 U[e]	0.05 U	0.05 U	—	0.05 U	1.0
Nitrate nitrogen (mg/L)	1.44	1.02	1.05	—	0.991	10.0
Total nitrogen[f]	1.697	1.392	1.366	—	1.435	NA
Total dissolved solids (mg/L)	427	342	264	—	274	500
Aluminum (mg/L)	0.025 U	**5.17**[g] (0.007)[h]	0.025 U	—	0.025 U	0.2
Antimony (mg/L)	0.0005 U	0.0005 U (0.0005 U)	0.0005 U	—	0.0005 U	0.006
Arsenic (mg/L)	0.005 U	0.005 U	0.005 U	—	0.005 U	0.05
Barium (mg/L)	0.0465	0.181 (0.052)	0.0711	—	0.0794	2.0
Cadmium (mg/L)	0.0025 U	0.0025 U (0.0001U)	0.0025 U	—	0.0025 U	0.005
Chloride (mg/L)	18.5	14.7	13.1	—	11.5	250
Cobalt (mg/L)	0.0025 U	0.0025 U (0.0001 U)	0.0025 U	—	0.0025 U	NA
Copper (mg/L)	0.0025 U	0.126 (0.002 U)	0.0037	—	0.0025 U	1.3
Fluoride (mg/L)	0.231	0.211	0.176	—	0.185	4.0

WELL NAME	USGS-065 (GW-016102)	TRA-07 (GW-016103)	USGS-076 (GW-016104)	TRA-08 (GW-016105)	Middle-1823 (GW-016106)	PCS/SCS[a]
Iron (mg/L)	0.025 U	**10.7** (0.235)	0.025 U	—	0.025 U	0.3
Manganese (mg/L)	0.0025 U	**0.145** (0.002)	0.0025 U	—	0.0025 U	0.05
Mercury (mg/L)	0.0002 U	0.0002 U (0.00007 U)	0.0002 U	—	0.0002 U	0.002
Selenium (mg/L)	0.002	0.0017 (0.001 U)	0.0013	—	0.0014	0.05
Silver (mg/L)	0.005 U	0.005 U (0.0002 U)	0.005 U	—	0.005 U	0.1
Sulfate (mg/L)	160	77.7	32.1	—	35.8	250

a. Primary constituent standards (PCS) and secondary constituent standards (SCS) in groundwater referenced in the Ground Water Quality Rule, IDAPA 58.01.11.200.01.a and b.
b. Water level measurement was obtained prior to determining well would not produce enough water to collect samples.
c. NA- Not applicable.
d. Well had insufficient volume of water to collect samples. Well is reported as “Dry” in accordance with Section G.5 of the ATR Complex CWP IWRP.
e. U flag indicates that the result was reported as below the instrument detection limit by the analytical laboratory.
f. Total nitrogen is calculated as the sum of the total Kjeldahl nitrogen, nitrite nitrogen, and nitrate nitrogen. Half the nitrite nitrogen detection limit was used in the total nitrogen calculations.
g. Concentrations shown in bold are above the Ground Water Quality Rule SCSs.
h. Sample results in parenthesis are from filtered metals sample collected on 10/16/08 from well TRA-07.

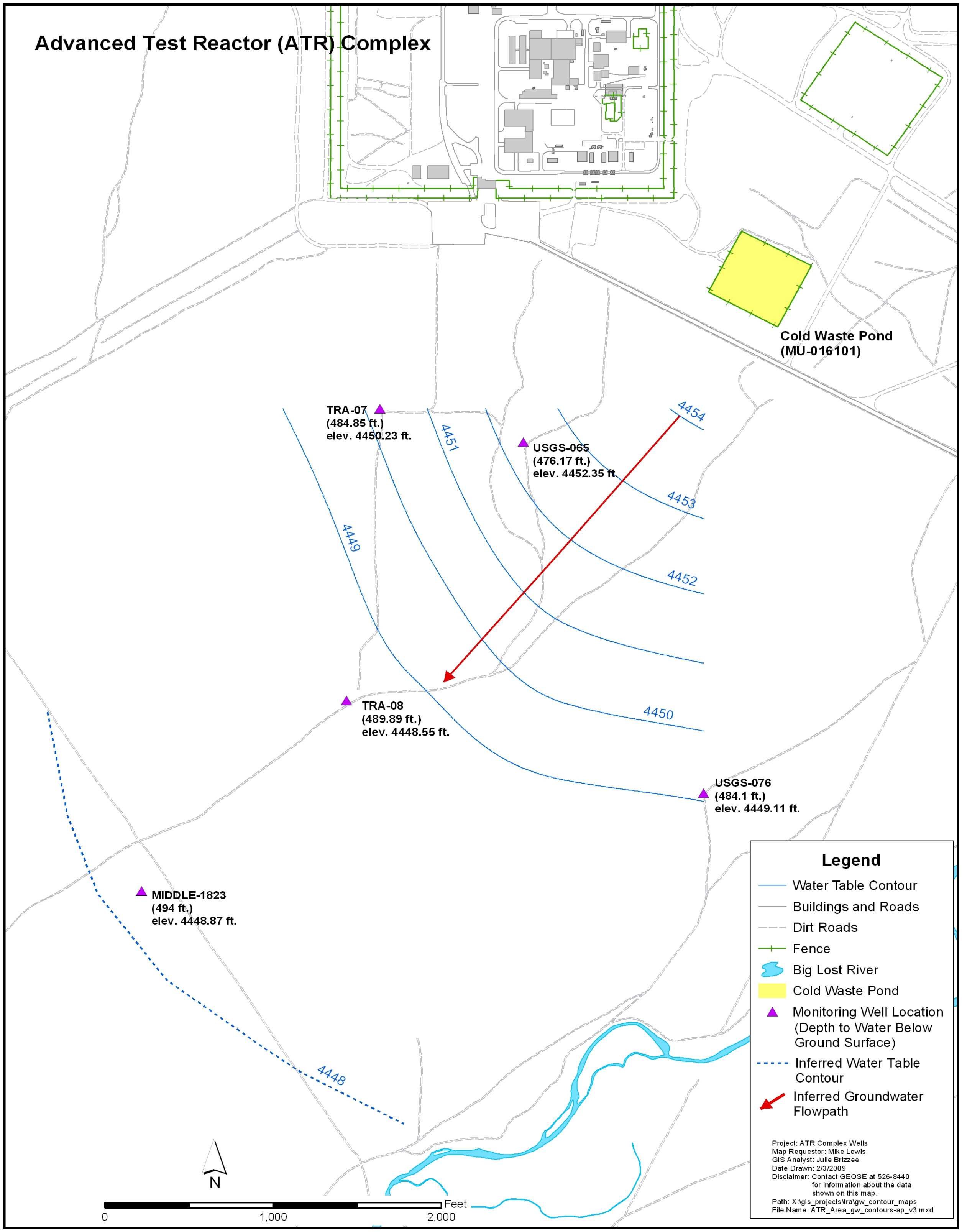

Figure 3. Groundwater contour map.

5 PERMIT YEAR SUMMARIES

This section provides information and status associated with permit required compliance activities. Non-compliance issues are also addressed in this section. Section 5.3 discusses issues that were not considered non-compliances but were not typical operational events.

5.1 Status of Permit Required Compliance Activity

Section E of the current ATR Complex IWRP identifies one compliance activity and specifies the completion date. Section H, Paragraph 5, of the permit requires that DEQ be notified within 30 days of completing any work described in Section E, and that the annual report shall provide the status of compliance activities still in progress at the end of the permit year.

Compliance Activity CA-161-01 requires a Plan of Operation to be submitted to the DEQ within six months after permit issuance. The compliance activity states:

> "A final Operation and Maintenance (O&M) Manual for the wastewater reuse facility, incorporating the requirements of this permit shall be submitted to the Department for review and approval. The manual may reference other written procedures required for the operation and maintenance of the Cold Waste Pond system. Upon approval, the manual shall be incorporated by reference into this permit and shall be enforceable as a part of this permit."

A letter (Stenzel 2008b) requesting extension of the due date for CA-161-01 was submitted to the DEQ on August 20, 2008. The letter requested extending the due date from August 26, 2008 to October 24, 2008. The DEQ granted the extension in a letter (Rackow 2008) dated August 26, 2008. The Plan of Operation was submitted to the DEQ on October 23, 2008 (Stenzel 2008a).

5.2 Non-compliance Issues

There were two non-compliance issues during the IWRP reporting year of February 26, 2008, through October 31, 2008. The first issue concerned effluent TDS sample preservation. The second issue was that the Al, Fe, and Mn exceeded the Ground Water Quality Rule SCSs in samples collected from well TRA-07.

5.2.1 Effluent TDS Sample Preservation

The May 2008 effluent sample result was 3,110 mg/L (see Table 1). This result was approximately 2.5 times the maximum TDS concentration of 1,320 mg/L observed for calendar years 2005 through 2007 (Stenzel 2008a). The June 2008 TDS sample result was 687 mg/L and within historical minimums and maximums. However, the following July sample result was 4,190 mg/L with the subsequent August through October samples also showing relatively high concentrations of TDS.

An investigation into possible changes in operation was undertaken. The purpose of the investigation was to determine whether there had been any operational changes that would have caused an increase in TDS. No process changes were identified that would have resulted in the high TDS results.

The EMS investigated its sampling activities and found that the May 2008 through November 2008 TDS samples had been incorrectly preserved with sulfuric acid. The correct method is to cool the samples to 4 degrees Celsius. Further investigation found that there was a transcription error in the Sampling and Analysis Plan that required sulfuric acid to be used. This error was then carried over to the labels placed on the sample bottles prior to sample collection resulting in EMS personnel adding sulfuric acid to the sample bottle. Although the November 2008 TDS sample was preserved with sulfuric acid, the mistake was identified in time to allow a portion of the TSS sample (preserved at 4 degrees Celsius) to be analyzed for TDS. The Sampling and Analysis plan has been revised to use the correct preservation method for future sampling events.

The DEQ was notified of the TDS issue during a conference call (CCN 215751) conducted on December 1, 2008 (Lewis 2008). During the call, BEA stated that the May 2008 through October 2008 TDS data would be flagged in the annual report as “rejected”. Rejected data is not used in calculations or for comparison purposes.

5.2.2 Aluminum, Iron, and Manganese Concentrations in Samples Collected from Well TRA-07

Well TRA-07 was sampled on October 16, 2008. The well was purged seven volumes prior to sampling. The pH, conductivity, and temperature stabilized before the samples were collected. Notes in the Groundwater Sampling Logbook indicate that the purge water was brownish and cloudy throughout the purging process. BEA EMS and CH2M-WG Idaho, LLC (CWI) personnel co-sampled the well. BEA EMS personnel collected unfiltered samples; CWI collected a filtered sample for metals.

The Well TRA-07 Al, Fe, and Mn unfiltered sample concentrations were above their respective SCSs (see Table 4). Also shown in Table 4 are the filtered sample results for these three metals, which are below the SCSs and significantly less than those in the unfiltered sample.

Table 4. Comparison of results from unfiltered and filtered samples collected from well TRA-07 on October 16, 2008.

Parameter	**Unfiltered (mg/L)**	**Filtered (mg/L)**	**SCS[a] (mg/L)**
Aluminum	5.17	0.007	0.2
Iron	10.7	0.235	0.3
Manganese	0.145	0.002	0.05

a. Secondary constituent standards (SCS) in groundwater referenced in the Ground Water Quality Rule, IDAPA 58.01.11.200.01.b.

Various data and information (i.e., groundwater sampling, the nature of unfiltered and filtered metals analysis, previous INL groundwater monitoring well studies, CWP effluent monitoring, and DEQ guidance) all support a determination that the effluent to the CWP is not expected to be the direct cause of the well TRA-07 Al, Fe, and Mn unfiltered sample concentrations exceeding the SCSs. Discussion of these data and information follow.

Filtered metals analysis only measures those metals dissolved in the groundwater. Unfiltered metals analysis measures both the metals dissolved in groundwater and metals which are associated with particulates. The difference in concentrations between the filtered and unfiltered metals sample data (see Table 4) indicates that most of the Al, Fe, and Mn present in well TRA-07 is not in dissolved form. The logbook description of the water as brownish and cloudy during well purge is also an indicator that the majority of the Al, Fe, and Mn in the sample is from particles in the groundwater, not from the dissolved fraction. The current DEQ “Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater” (DEQ 2007) states “only dissolved metals truly migrate in groundwater”. Further, the Snake River Plain aquifer itself is a source of Al, Fe, and Mn. Analysis of suspended sediment in several INL monitoring wells concluded that Al, Fe, and Mn are common in the sedimentary interbeds and basalt that comprise the Snake River Plain aquifer (Hull 2004).

Sample results from the effluent to the CWP and from well USGS-065 also indicate that discharges to the CWP are not expected to be the direct cause of the high Al, Fe, and Mn in the unfiltered sample from TRA-07 as discussed below:

- The effluent Al, Fe, and Mn concentrations are typically well below the SCSs. Table 1 shows the 2008 permit year concentrations for these metals (note - Al analysis is not a permit requirement, but is included with the laboratory's standard metals analysis). All of the effluent Al concentrations for the 2008 reporting year were below the laboratory instrument detection level of 0.025 mg/L.
- Well USGS-065 (the nearest down gradient well to the CWP) monitoring data (see Table 3) shows that the Al, Fe, and Mn unfiltered sample concentrations were below the laboratory instrument detection limits for all three metals.

The possibility of using filtered compliance samples for Al, Fe, and Mn was discussed with the DEQ on December 1, 2008 (Lewis 2008). It was noted that the Board of Environmental Quality has adopted a pending rule change to IDAPA 58.01.11 (Ground Water Quality Rule) that would allow dissolved concentrations of SCSs to be used for compliance purposes. For this to be allowed, the pending rule requires that it must be shown that there will be no adverse effects to human health or the environment. The pending rule will become final and effective on July 1, 2009, if approved by the Idaho State Legislature.

If the rule becomes final, using filtered samples for compliance purposes will be addressed with the DEQ for those metals having SCSs. In the interim, both filtered and unfiltered samples will be collected during the April 2009 IWRP sampling event.

5.3 Operational Issues

This section discusses operational issues for the ATR Complex Cold Waste system that occurred during the permit year. These issues were not considered non-compliance issues.

5.3.1 Leak in Cold Waste Line

On August 4, 2008, a trench was being dug to connect the newly constructed Common Support Building to a new section of the Cold Waste line. This new section of the Cold Waste line is located in the Utility Corridor. While the trench was being dug, an excavator put a small hole in the Cold Waste line. The line was empty at the time and therefore, there was no discharge to the soil. However, on August 5, 2008, the Advanced Test Reactor was shut down. During the shutdown, wastewater from a heating and ventilation system chiller normally discharged to the cooling towers was routed to the Cold Waste system. This additional wastewater caused the wastewater to backup into the empty section of the new Cold Waste line. It was estimated that approximately 10 gallons of wastewater leaked from the hole into the soil. A temporary patch was placed over the hole on August 7, 2008. The permanent repair of the leak was completed on August 11, 2008.

There are no expected environmental impacts from the wastewater leak. The 10 gallons of wastewater that leaked to the soil is the same wastewater that is normally discharged to the CWP. There was no radioactive contamination associated with the leaked wastewater.

5.3.2 Oil Release to a Cold Waste System Drain

Building TRA-633 houses a diesel powered fire water pump. On September 15, approximately one cup of oil that had leaked from the diesel engine's crankcase entered a drain leading to the CWP. The oil was washed down the drain during a maintenance activity that required an operator to disconnect a bypass water hose that was adjacent to the pump engine. The residual water in the bypass hose leaked around the pump engine and carried the oil to the drain.

ATR Complex personnel inspected the CWP to determine if there was a visible oil sheen on the water. No visible sheen was observed. Plant personnel were assigned to evaluate alternatives to correct the drain configuration.

Regulatory requirement IDAPA 58.01.02.851.04.b states: "An above ground spill or overfill of petroleum that results in a release that is less than twenty-five gallons and does not cause a sheen on nearby surface water shall be reported to the Department only if cleanup cannot be accomplished within twenty-four hours." Because of the type of release, it was not possible to clean up the oil within twenty-four hours. As a result, the DEQ was notified on September 18, 2008 via conference call. The verbal notification was later followed up with a fax of a completed INL Substance Release Form (230.07).

5.3.3 Inoperable Post Indicator Valve

The CWP is divided into two cells (north and south). Normal operation is to divert the Cold Waste wastewater to either the north or south cell, although the procedure (OMM-8.2.13.1.17, "Switching Cold Waste Ponds") allows for operation of both cells simultaneously. On September 9, 2008, the south cell post indicator valve (PIV) was opened to allow flow into the south cell. After the south cell PIV was opened, an attempt was made to close the north cell PIV. It was found that the north PIV was stuck and could not be closed. A request to replace the valve has been submitted to the work order control system. For the remaining permit year, the flow was directed to both cells.

6 ENVIRONMENTAL IMPACTS

The IWRP allows 300 MG/year as a five year annual average, not to exceed 375 MG annually. The total volume discharged to the CWP for this period (February 26, 2007 through October 31, 2008) was 129.25 MG. The average daily flow during the 2008 permit year was 519,090 gallons. No runoff occurred from the application area.

High effluent concentrations of TSS have the potential to reduce the infiltration capacity of the soil. Section F of the IWRP specifies a TSS effluent limit of 100 mg/L. All monthly TSS concentrations in the effluent were well below the permit limit and also below the laboratory instrument detection limit of 4 mg/L (Table 1). No negative impacts to the soil infiltration capacity from TSS loading are expected.

The IWRP effluent limit for TN is 20 mg/L. The monthly effluent TN concentrations were well below the permit limit ranging from 1.239 mg/L to 3.871 mg/L (Table 1). Nitrogen can be lost or removed from the soil by leaching, ammonia volatilization, and denitrification. Total nitrogen in the nearest down gradient well (USGS-065) from the CWP was 1.7 mg/L (Table 3). Although there is not a groundwater quality standard for TN, there is a standard for nitrate (10 mg/L) and nitrite (1 mg/L). The October 2008 sample results from well USGS-065 had a nitrate concentration of 1.44 mg/L and a nitrite concentration of less than 0.05 mg/L (undetected). Both were significantly less than their respective groundwater quality standards.

Sulfate and TDS concentrations (see Table 1) in the effluent have the potential to impact groundwater. Sulfate has high solubility and tends to move at a similar velocity as the groundwater. Sulfate concentrations in the 2008 permit year effluent monthly samples ranged from a low of 21.2 mg/L to a high of 618.0 mg/L. Only the TDS concentrations for March (1,090 mg/L) and April (244 mg/L) were valid due to sample preservation issues (see Section 5.2.1). There are no IWRP effluent limits for sulfate and TDS. However, there are groundwater quality standards for these two parameters.

The groundwater quality SCS for sulfate is 250 mg/L and 500 mg/L for TDS. Well USGS-065, the nearest well down gradient of the CWP had the highest sulfate and TDS concentrations at 160 mg/L and 427 mg/L (see Table 3), respectively. Well TRA-07 exhibited the next highest concentration of sulfate and TDS at 77.7 mg/L and 342, mg/L, respectively. Well USGS-076, considered more up/cross gradient, had much lower concentrations of sulfate (32.1 mg/L) and TDS (264 mg/L).

Elevated sulfate and TDS concentrations in the groundwater can be seen near the CWP which quickly dissipates with distance from the pond. This can be seen when comparing the sulfate and TDS concentrations found in well USGS-065 and Middle-1823. Well Middle-1823, located approximately 4,000 ft down gradient from the CWP has sulfate and TDS concentrations of 35.8 mg/L and 274 mg/L, respectively. Well USGS-065, located approximately 1,200 ft down gradient of the CWP had a sulfate concentration of 160 mg/L and a TDS concentration of 427 mg/L. The concentrations of sulfate and TDS in well Middle-1823 are similar to the concentrations in the up/cross gradient well USGS-076.

As stated above, sulfate and TDS have SCSs for groundwater quality. The SCSs are generally based on aesthetic qualities including odor, taste, color, and foaming (EPA 1992). Sulfate is listed for causing a “salty taste” in drinking water. Total dissolved solids are listed for “hardness deposits, colored water, staining, and salty taste.” The nearest drinking water well is located approximately 3 miles down gradient of the CWP. Since these contaminants remain, and are expected to continue to remain, localized near the CWP and since they are regulated because of their aesthetic qualities, impacts to human health and the environment are expected to be minimal.

The October 2008 unfiltered sample results for Al, Fe, and Mn in well TRA-07 were above their respective SCSs, whereas, the filtered sample results for these three metals were all below the SCSs (see Table 4). Sample results from the effluent to the CWP and from well USGS-065 indicate that discharges to the CWP are not expected to be the direct cause of the high Al, Fe, and Mn in the unfiltered sample. It is likely that the higher concentrations of Al, Fe, and Mn in well TRA-07 are due to suspended solids found within the well. The high levels of Al, Fe, and Mn appear to be confined to well TRA-07 since the concentrations of these metals in the other two down gradient wells were below the instrument detection limits (Table 3). All three metals have an impact on color of the water. Both iron and manganese cause staining and also cause the water to have a metallic taste. However, similar to the sulfate and TDS concentrations in the groundwater near the CWP, impacts to human health and the environment from concentrations of Al, Fe, and Mn in well TRA-07 are expected to be minimal.

There are positive impacts to the environment associated with the operation of the CWP. These include returning a significant portion of the industrial wastewater to the aquifer and providing needed water for several native wildlife species in an otherwise arid environment.

7 REFERENCES

40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," *Code of Federal Regulations*, Office of the Federal Register.

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, Office of the Federal Register.

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[a] Correct reference is RTC

Appendix A

Daily Discharge Volumes to the Advanced Test Reactor Complex Cold Waste Pond

Appendix A

Daily Discharge Volumes to the Advanced Test Reactor Complex Cold Waste Pond

Table A-1. Daily discharge volumes to the ATR Complex CWP for 2008

Date	Daily Discharge Volume (gallons)
02/26/2008	273,150
02/27/2008	363,200
02/28/2008	358,110
02/29/2008	402,780
03/01/2008	371,490
03/02/2008	319,540
03/03/2008	413,110
03/04/2008	319,800
03/05/2008	355,140
03/06/2008	417,050
03/07/2008	326,220
03/08/2008	881,210
03/09/2008	991,880
03/10/2008	947,120
03/11/2008	632,720
03/12/2008	812,720
03/13/2008	770,700
03/14/2008	823,050
03/15/2008	705,800
03/16/2008	761,750
03/17/2008	947,310
03/18/2008	633,240
03/19/2008	765,400
03/20/2008	973,780
03/21/2008	649,220
03/22/2008	841,440
03/23/2008	600,110
03/24/2008	782,230
03/25/2008	895,800
03/26/2008	675,230

Date	Daily Discharge Volume (gallons)
03/27/2008	853,360
03/28/2008	708,250
03/29/2008	688,470
03/30/2008	774,110
03/31/2008	777,300
04/01/2008	967,000
04/02/2008	702,500
04/03/2008	621,110
04/04/2008	626,910
04/05/2008	770,030
04/06/2008	674,020
04/07/2008	902,300
04/08/2008	645,300
04/09/2008	718,220
04/10/2008	504,420
04/11/2008	830,200
04/12/2008	751,000
04/13/2008	709,200
04/14/2008	875,400
04/15/2008	660,920
04/16/2008	1,152,700
04/17/2008	452,660
04/18/2008	1,078,030
04/19/2008	768,020
04/20/2008	806,720
04/21/2008	653,420
04/22/2008	849,600
04/23/2008	516,220
04/24/2008	975,500
04/25/2008	787,610

Date	Daily Discharge Volume (gallons)
04/26/2008	698,000
04/27/2008	710,960
04/28/2008	676,930
04/29/2008	884,000
04/30/2008	861,420
05/01/2008	633,080
05/02/2008	215,410
05/03/2008	189,430
05/04/2008	276,100
05/05/2008	297,490
05/06/2008	360,220
05/07/2008	339,980
05/08/2008	429,700
05/09/2008	341,630
05/10/2008	387,090
05/11/2008	310,540
05/12/2008	360,110
05/13/2008	389,890
05/14/2008	333,670
05/15/2008	345,100
05/16/2008	367,650
05/17/2008	325,630
05/18/2008	358,110
05/19/2008	464,000
05/20/2008	294,450
05/21/2008	417,400
05/22/2008	408,010
05/23/2008	306,010
05/24/2008	436,690
05/25/2008	380,850
05/26/2008	246,920
05/27/2008	357,600
05/28/2008	424,200
05/29/2008	307,730
05/30/2008	380,000
05/31/2008	304,920
06/01/2008	365,210

Date	Daily Discharge Volume (gallons)
06/02/2008	531,220
06/03/2008	580,630
06/04/2008	679,500
06/05/2008	223,690
06/06/2008	318,090
06/07/2008	326,580
06/08/2008	276,860
06/09/2008	320,460
06/10/2008	304,060
06/11/2008	302,970
06/12/2008	368,290
06/13/2008	269,000
06/14/2008	336,000
06/15/2008	234,590
06/16/2008	374,710
06/17/2008	242,280
06/18/2008	364,420
06/19/2008	317,070
06/20/2008	334,870
06/21/2008	724,700
06/22/2008	829,000
06/23/2008	685,420
06/24/2008	739,830
06/25/2008	783,500
06/26/2008	752,630
06/27/2008	635,060
06/28/2008	779,920
06/29/2008	718,560
06/30/2008	850,830
07/01/2008	903,400
07/02/2008	732,300
07/03/2008	842,600
07/04/2008	804,150
07/05/2008	295,810
07/06/2008	864,750
07/07/2008	536,790
07/08/2008	598,350

Date	Daily Discharge Volume (gallons)
07/09/2008	398,000
07/10/2008	313,710
07/11/2008	461,010
07/12/2008	280,020
07/13/2008	324,500
07/14/2008	389,410
07/15/2008	440,810
07/16/2008	459,900
07/17/2008	405,100
07/18/2008	369,490
07/19/2008	423,800
07/20/2008	375,470
07/21/2008	344,410
07/22/2008	404,000
07/23/2008	292,160
07/24/2008	442,500
07/25/2008	369,550
07/26/2008	472,610
07/27/2008	332,990
07/28/2008	441,310
07/29/2008	490,000
07/30/2008	366,100
07/31/2008	422,730
08/01/2008	471,100
08/02/2008	425,360
08/03/2008	369,600
08/04/2008	414,320
08/05/2008	814,110
08/06/2008	709,370
08/07/2008	481,510
08/08/2008	443,900
08/09/2008	445,400
08/10/2008	328,000
08/11/2008	404,090
08/12/2008	469,000
08/13/2008	337,750
08/14/2008	525,660

Date	Daily Discharge Volume (gallons)
08/15/2008	387,710
08/16/2008	353,000
08/17/2008	497,000
08/18/2008	313,080
08/19/2008	433,900
08/20/2008	436,070
08/21/2008	366,120
08/22/2008	405,700
08/23/2008	449,190
08/24/2008	422,390
08/25/2008	345,650
08/26/2008	482,670
08/27/2008	333,420
08/28/2008	498,480
08/29/2008	434,010
08/30/2008	457,200
08/31/2008	970,200
09/01/2008	676,270
09/02/2008	741,010
09/03/2008	837,760
09/04/2008	537,694[a]
09/05/2008	2,390[a]
09/06/2008	31,067[a]
09/07/2008	372,210
09/08/2008	507,930
09/09/2008	508,800
09/10/2008	534,190
09/11/2008	218,449[b]
09/12/2008	136,530[b]
09/13/2008	166,211[b]
09/14/2008	949,190
09/15/2008	571,010
09/16/2008	864,440
09/17/2008	679,510
09/18/2008	640,260
09/19/2008	866,000
09/20/2008	665,820

Date	Daily Discharge Volume (gallons)
09/21/2008	721,020
09/22/2008	1,123,000
09/23/2008	234,260
09/24/2008	216,000
09/25/2008	432,270
09/26/2008	296,040
09/27/2008	284,320
09/28/2008	280,640
09/29/2008	367,030
09/30/2008	272,080
10/01/2008	344,280
10/02/2008	387,240
10/03/2008	378,000
10/04/2008	348,000
10/05/2008	389,770
10/06/2008	253,010
10/07/2008	324,470
10/08/2008	353,280
10/09/2008	396,830
10/10/2008	451,950
10/11/2008	398,670

Date	Daily Discharge Volume (gallons)
10/12/2008	396,720
10/13/2008	408,490
10/14/2008	544,400
10/15/2008	383,000
10/16/2008	682,100
10/17/2008	486,290
10/18/2008	766,020
10/19/2008	697,320
10/20/2008	751,800
10/21/2008	674,530
10/22/2008	457,740
10/23/2008	451,100
10/24/2008	526,130
10/25/2008	479,010
10/26/2008	546,490
10/27/2008	751,600
10/28/2008	334,650
10/29/2008	308,510
10/30/2008	461,270
10/31/2008	363,050

a. Daily flow was estimated by scaling total flow recorded for 9/6/08 by the pump operational hours for the 9/4/08 through 9/6/08.

b. Daily flow was estimated by scaling total flow recorded for 9/13/08 by the pump operational hours for the 9/11/08 through 9/13/08.